

such an action, and an auxiliary, but decidedly feeble, power to the setæ, there are many cases of molluscous excavation also in which chemical erosion has a large share in the result.

3. A few words remain to be said as to the specific title and distinction of the lithodomous *Leucodore*. In the first place, it appears, from the remarks of Mr. Alexander Agassiz, lately published in this Magazine, that *Leucodore* of Johnston is truly a synonym of *Polydora* of Bosc. Claparède and De Quatrefages have both described species as belonging to the genus *Leucodore*, which do not possess the characteristic modification of the fifth segment, and are really species of *Nerine* of Johnston. If this be so, Johnston's name *Leucodore* will have to fall. At the same time, it seems probable that both generic terms will be wanted; and I will not undertake to say how each shall be limited. The boring species does not differ obviously from *Leucodore ciliata*. I have not been able to make a comparison of specimens; but it seems probable that they differ only in habit. Nevertheless, on account of this habit, it may be well to give Templeton's title (which has precedence) of "*calcarea*" to the boring form, which may be designated *Polydora (Leucodore, Johnst.) calcarea*. The same form of seta (fig. 10), the same copious ciliation of the branchial cirri which arch over the dorsum, the same remarkable anal cup or sucker (?), and the same form of head, with two tentacles which readily drop off, and a producible prostomium, characterize both *P. ciliata* and *P. calcarea*. It is quite possible that more careful examination may disclose marked specific differences, not only between these, but also between the various individuals boring limestone, chalk, &c.

XXX.—*On the Occurrence of the Genus Ptilograpsus in Britain; with Notes on the Ludlow Graptolites.* By HENRY ALLEYNE NICHOLSON, D.Sc., M.B., F.G.S.

THE genus *Ptilograpsus* was originally described by Hall as occurring in the Quebec group in Canada; and two species have been differentiated by him, viz. *P. plumosus* and *P. Geinitzianus* (see 'Graptolites of the Quebec Group,' pp. 139, 140, pl. 21. figs. 1-8). In the Skiddaw Slates, our English equivalent of the Quebec group, no traces of this genus have hitherto been found; nor does it appear to occur in the Upper Llandeilo rocks of the south of Scotland, or in the Coniston Flags in the north of England—both especially rich in forms of Graptolites. Recently, however, by the kindness of Mr. Lightbody and Mr. Marston, of Ludlow, I have been furnished

with specimens of a new species of *Ptilograpsus*, which I purpose to describe briefly under the name of *P. anglicus*. The generic characters of *Ptilograpsus* consist in the possession of a branching plant-like frond, the branches and branchlets plumose. The pinnules spring alternately from opposite sides of both the primary and secondary divisions of the frond, and are celluliferous on one side only. The base of the frond is not known, the probability, however, being that the organism was fixed.

As pointed out by Hall, *Ptilograpsus* closely resembles the modern *Plumularia*; and, as far as its characters are yet known, there is perhaps no really important point of difference. Certainly the resemblance to such forms as *Plumularia cristata* and *P. myriophyllum*, the first especially, is most striking, and must be more than merely mimetic. Like *Dictyonema*, *Dendrograpsus*, and *Callograpsus* (all genuine Graptolites), *Ptilograpsus* was probably permanently attached, though in none of these genera has the commencement of the "hydrocaulus" been yet detected. Another point in which *Ptilograpsus* agrees with the above-mentioned genera and differs from the great majority of Graptolites is in the apparent absence of the "solid axis"*, the individual branchlets consisting simply of cellules or "hydrothecæ" springing from a common canal or "cœnosarc." By this absence of the solid axis, of all Graptolitic structures the most anomalous, *Ptilograpsus* manifestly approaches very closely to the Sertularian type, though not more closely, perhaps, than do *Callograpsus* and *Dendrograpsus*. *Dictyonema*, again, though certainly belonging to the same natural subgroup of the Graptolitidæ as the above three genera, has a fresh structure superadded in the shape of transverse dissepiments connecting together the different branches which constitute the frond.

Ptilograpsus anglicus, spec. nov.

Spec. char. Frond slender and branching, all the branches, large and small, being provided with pinnulæ, which spring alternately from opposite sides, and bear angular cellules on one face. Pinnulæ from twenty to twenty-eight in an inch, their length varying from two to three twentieths of an inch.

* The "solid axis" has usually been supposed to be an essential element in the structure of every Graptolite, the genus *Retiolites* alone excepted. In common with the great majority of writers on the subject, this belief was shared by myself, and I did not believe that even the above-mentioned exception would be found to hold good. Recent investigations, however, into this particular point have led me to the opinion that the axis is not so constantly present as has been generally thought, that it is certainly absent in the genera I have spoken of, and probably absent in others.

The cellules are from three to six on a pinnule; when well exhibited, they are angular, projecting, and closely resembling the cellules in some forms of *Graptolites Nilssoni*, Barr. The test is corneous, and there are no traces of any solid axis.

The entire frond is not known to me; but I have seen fragments of nearly two inches in length. Whether this species is absolutely distinct from that of the Quebec group, termed by Hall *P. plumosus*, it is difficult to say, in the absence of the cellules of the latter. It is, however, highly improbable that the species should have survived through a period of time so vast as this would imply. Our species, too, is of a much more slender and graceful habit than is the case with either of the American species, whilst the branching is more diffuse and the pinnulæ are shorter.

Loc. In a greenish-grey mudstone, of Lower Ludlow age, from Bow Bridge, near Ludlow.



Ptilograpsus anglicus, spec. nov.

1. A small portion of a frond, natural size.
2. A single branchlet, enlarged.
3. A single pinnule, enlarged, to show the cellules.
4. Branched Graptolite (*Ptilograpsus*?) from the Lower Ludlow rocks of Bow Bridge, near Ludlow, nat. size.
5. A portion of the same, enlarged, showing pinnulæ and cellules(?).

In the same bed with *Ptilograpsus anglicus* there occurs a branching fossil, in the same state of preservation as the former, and almost certainly Graptolitic, though I have failed to detect cellules except in one instance, and then not with certainty. I possess, however, but a single specimen, which I

owe to the kindness of Mr. Lightbody, of Ludlow. Its mode of branching is much more discrete than that of *P. anglicus*; and the branches, which arise alternately from opposite sides, are not provided with pinnulæ or cellules near their origins. Whether true pinnulæ are developed on the terminal portions of the branches, or not, is doubtful; but both pinnulæ and cellules appear to be present on one of the branches of my specimen (see fig. 5). If this is really the case, then the fossil would form a new species of *Ptilograpsus*; but it is just possible that it may be referable to *Dendrograpsus*, a genus equally ancient with the former, and equally unknown in beds of such a late age.

Besides the above, the Ludlow rocks in the neighbourhood of Ludlow contain at least three other species of Graptolites. One of these is the familiar *Graptolites priodon* of Bronn—the *G. ludensis* of the ‘Silurian System.’ The second is certainly distinct from *G. priodon*, though none of the specimens at present in my possession are in a state of sufficiently good preservation to enable me to come to an accurate determination. It is identical with a Graptolite which occurs in the “sheer-bate” beds at the top of the Coniston Flags of the north of England; and it seems almost, if not quite, undistinguishable from one of the forms of *G. colonus*, Barr. (See Barrande, *Graptolites de Bohème*, pl. 2. fig. 5; Geinitz, *Graptolithen*, pl. 2. fig. 34.) The third presents a considerable resemblance to some varieties of *G. Nilssoni*, and also to the younger forms of *G. sagittarius*, Linn.; but it is remarkable for the peculiarity that the cellules are on the concave (instead of the convex) side of the stipe. This condition is probably of specific value; but it seems better to refrain from making a new species until, by the examination of an extensive suite of specimens, the peculiarity in question is proved to be constantly and persistently present. Whether specifically distinct or not, the existence in the Ludlow rocks of a form so closely allied to the above-mentioned Lower-Silurian species, along with a genus hitherto only known from the base of the Lower Llandeilo series, is a highly suggestive and noteworthy fact. For one thing, it seems to be exceedingly probable that the Graptolitidæ will ultimately be found to be not so exclusively Silurian as has generally been supposed. Hall has taken the first step in this direction by the discovery in America of species of *Dictyonema* in the Old Red Sandstone (Upper Helderberg and Hamilton groups); and subsequent researches will very probably show the coexistence with these of other genera of which the Graptolitic nature is more universally acknowledged.